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ET-152 October 1939

United States Department of Agriculture
Bureau of Entomology and Plant Quarantine

A METHOD FOR TESTING THE VALUE OF CHEMICAL MIXTURES AS REPELLENTS OF THE GULF COAST TICK

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Studies on repellents of the Gulf Coast tick (Amblyomma maculatum Koch) have been conducted at the Valdosta, Ga., laboratory of this Bureau for some time. These studies, conducted by H. Hixson and later by H. M. Brundrett, were wholly field experiments on either animals at the Government experimental farm at Valdosta, or on animals belonging to plantation owners in southern Georgia. In these tests the ears of naturally infested range animals were treated with various chemicals, and the animals were then examined at regular intervals for the presence of ticks on the treated ears.

This type of field test was found to be unsatisfactory for determining the value of different chemicals as tick repellents. The comparatively short working period (2 to 3 months of maximum tick abundance during the year), the meager amount of clear-cut data obtained from extensive experiments, the dependence on the variable abundance of ticks in nature, and many other factors made it advisable to search for a more satisfactory method.

The method finally adopted employs an adjustable headgear and two cylindrical cages held tightly in place, one over each ear. The apparatus in its position on the head of an animal is outlined in figure 1.

Each cylindrical cage is $5\frac{3}{4}$ inches long and $2\frac{3}{8}$ inches in diameter. The supporting structure of the cylinder is a framework of leather, the outline of which is shown in figure 2. The greater part of the wall is 16-mesh screen which is attached to the inside

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*The author thanks E. E. Rogers, H. T. Vanderford, and Elihu B. Blakeslee for their assistance and suggestions in assembling a large number of the pieces of apparatus described herein for use in a preliminary test. Further thanks are extended to Mr. Blakeslee for assistance in conducting the test.

surface of the leather. The screen is strengthened and further supported inside by two circular metal rods soldered to the screen as a terminal circular brace (fig. 1, c.b.) and a subterminal brace. (s.b.) The vial holder (v.h.) is attached to the leather frame and hangs from the under side of the cylinder when the apparatus is in position. This vial holder can be made of any kind of strong cloth or flexible but strong leather. A soft cushion of cylindrical weather strip is sewed to the inner edge of the leather frame (fig. 1, c). This cushion reduces friction between the cage and skin and prevents injury to the skin.

Each cylinder can be opened or closed readily by the talon fastener (fig. 1, t.f.) which is attached to the leather frame in the front of the cylinder.

The leather frame also supports the halter, the buckles and straps of which are attached to it (fig. 1). The halter is adjustable within limits, depending on the total length of the straps or turnbuckles. The total lengths of the straps, including the amount necessary for the attachment, varies with the position of the strap. On the apparatus under discussion the length of the head strap (fig. 1, h.s.) is $8\frac{1}{2}$ inches; the nose strap (n.s.), $12\frac{1}{2}$; the muzzle strap (mu.s.), $14\frac{1}{2}$; the maxillary strap (m.s.), $9\frac{1}{2}$; and the neck strap (ne.s.), 9 inches.

A large number of these cages can be assembled rapidly by first preparing in quantity all the necessary parts to be used. The list will include leather forms cut to the pattern shown in figure 2, rectangles and circles of 16-mesh screen wire, rectangles of cloth, various lengths of strap leather, turnbuckles, metal rods shaped to circles and open circles, strap buckles, talon fasteners, cylindrical weather strip, and brass split rivets.

The assembling procedure is, briefly, as follows:

(1) Pleat a strip of cloth (8" x 1") and attach it to one of the shorter edges of a rectangle of heavy duck cloth (5" x $4\frac{1}{4}$"); sew this cloth to form a cylinder into which a shell vial (100 mm. x 25 mm.) will fit snugly.

(2) Attach pleated flare of this vial-holder cloth to vial-holder tab of leather frame (fig. 2, v.h.t.) by sewing it or by using brass split rivets, or by both.

(3) Sew cylindrical weather strip to inner edge (fig. 2, i.e.) of leather frame.

(4) Attach a rectangle of 16-mesh wire screen ($6\frac{1}{4}$" long by $4\frac{3}{4}$" wide) to the leather frame, by means of brass split rivets, so that the long edge of the screen coincides with the long edge of the leather frame. This screen will need to have a hole of the same size as that in the vial-holder tab, and the two holes must register when assembled.

(5) Attach the talon fastener to those edges of the leather frame that will form the anterior midline of the completed cage (fig. 2, a.m.) using casein glue as a temporary, and paper staples as a permanent, fastening.

(6) Shape the metal rods into closed and open circular braces. Solder these in place to the inside of the screen portion of the cage.

(7) Solder disk of 16-mesh wire screen to the circular brace to form the outside end of the cage.

(8) Attach the necessary straps, buckles, and turnbuckles to form the halter shown in figure 1.

Technique of an Experiment with the Apparatus

The chemical mixtures to be tested were applied to the ears of sheep. One week after treatment a set of ear cages was placed on each animal so that each cage covered one ear and both cages were held tightly to the head.

The animals were allowed to become accustomed to the cages for 2 days before vials containing male and female ticks were opened and quickly inserted into the vial holder. The vial holder was then tightly closed behind the vial to prevent the escape of the ticks.

Three times a week thereafter the ear cages and vial holders were opened and the ears and vials inspected. Records were kept of the number of ticks dead, the number attached, the number engorging, the progress of engorgement, and the number fully engorged. Engorged and dead ticks were removed at each examination.

Discussion

This experiment showed clearly the advantages of the new method over previous methods. The fate of the ticks on both the treated and control animals could be recorded readily in exact figures of the number dead, date of death, number engorged, rate of engorgement, etc. In this one experiment such information was recorded for 89.5 percent of the 412 ticks placed in the vial holders.

With this apparatus and a supply of adult ticks, experiments with repellents may be conducted for at least 8 months of the year as compared to 3 or 4 months with the previous method.

The cages were found to be sturdy, withstanding rubbing and buffetting by the host animals well. Out of 20 cages 5 were slightly damaged, but none seriously enough to affect the results of the experiment.

The cages and the halters did not injure the host animals in any way. Some of the wool was rubbed off at points of contact, but the slight friction did not result in any open wounds. During the first day or two after the apparatus was attached many of the sheep attempted to remove the cages, but as long as the straps and turnbuckles were tight and in place, none were dislodged. After the second day nearly all the sheep wore the cages with no further display of discomfort.

EXPLANATION OF FIGURES

Fig. 1. Sketch of ear cages and halter in position on a sheep.

b. - buckle
c. - cushion
c.b. - circular brace
c.t. - cheek turnbuckle
h.s. - head strap
l.f. - leather frame
m.s. - maxillary strap
mu.s. - muzzle strap
ne.s. - neck strap
n.s. - nose strap
s.b. - open circular brace
t.f. - talon fastener
v.h. - vial holder
v.h.t. - vial holder tab

Fig. 2. Pattern for leather frame of left ear cage

a.m. - anterior midline, edges to which talon fastener is attached

o. - opening in leather tab for entrance and exit of ticks between vial and ear cage

v.h.t. - vial holder tab

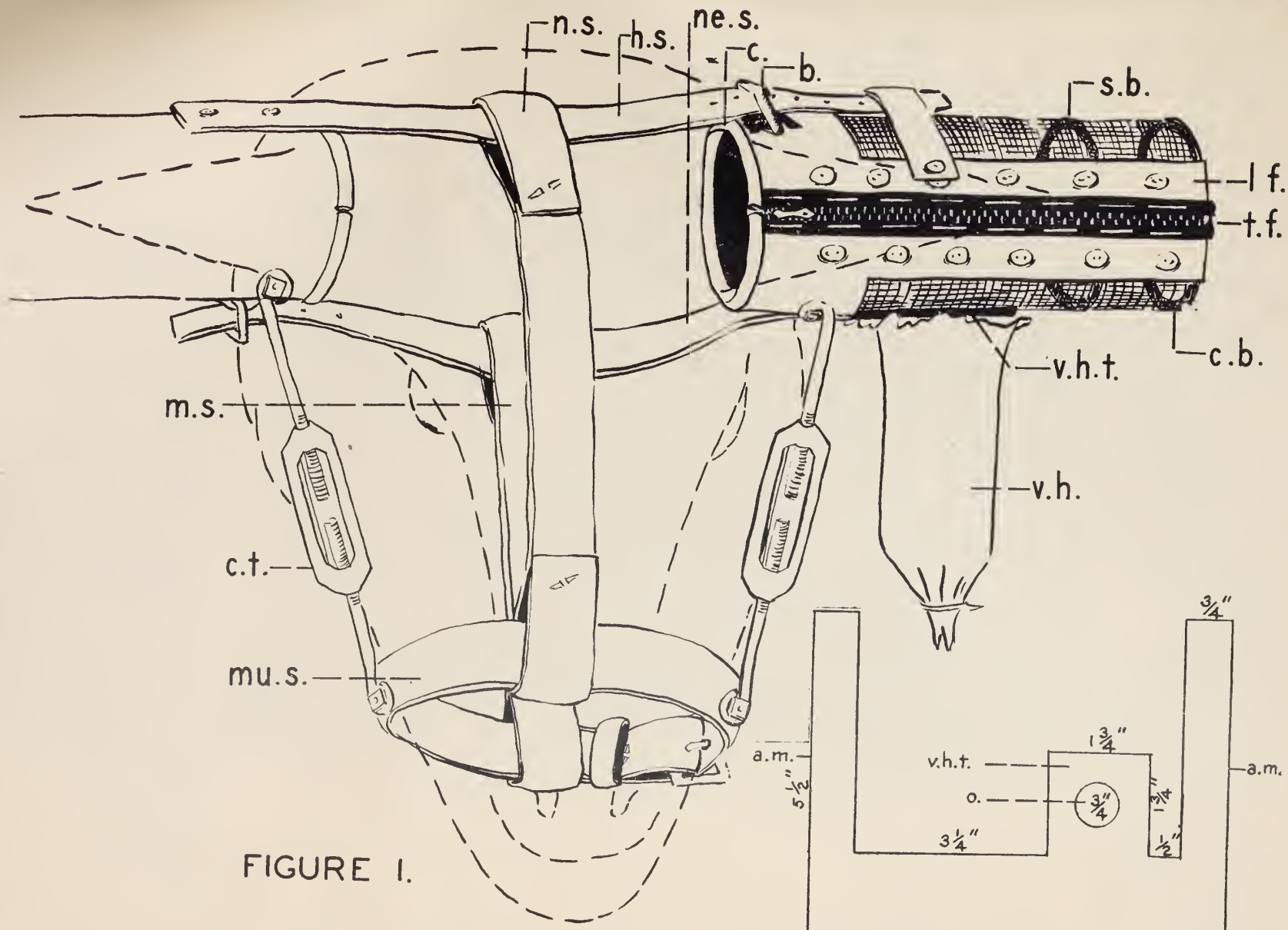

FIGURE 1.

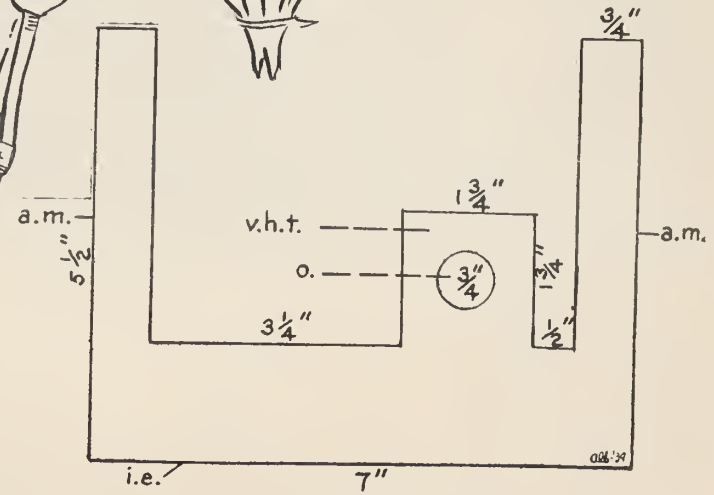

FIGURE 2

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